accelerant is selected from the group consisting of phosphites, borates, water, alkyl phosphine, arsine and borane derivatives, PH_3, AsH_3, B_2H_6, NF_3, NO_2 and CO_2.

34. (Amended Once) The film of claim 33 wherein the organic phosphite accelerants have the formula $(R"O)_3P$ where R" is independently chosen from straight, cyclic or branched-chain alkyl or alkenyl of from one to about six carbons; phenyl, substituted phenyl, or R"' CH_2CH_2-, where R"' is MeO_2C-, EtO_2C-, CH_3CO-, or HOOC-.

35. (Amended Once) The film of claim 33 wherein the organic borate accelerants have the formula $(R"O)_3B$ where R" is independently chosen from straight, cyclic or branched-chain alkyl or alkenyl of from one to about six carbons; phenyl, substituted phenyl, or R"' CH_2CH_2-, where R"' is MeO_2C-, EtO_2C-, CH_3CO-, or HOOC-.

REMARKS

The Amendments

The amendment to claim 33 combines claims 33, 34 and 35 and new claim 34 and 35 dependent on new claim 33 describe the organic phosphite and organic borate accelerants respectively. Column 5 of the original patent supports the definition of the organic phosphites and borates as now employed in claims 34 and 35.

The accelerant as defined in new claim 33 omits the oxygen and N_2O compounds of claim 35 in order to distinguish Gordon, United States Patent No. 4,187,336, column 9, lines 15-35. Applicants can drop one or more members of a

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Markush Group in view of a reference that would otherwise prevent applicants from claiming all of the species in the group where the Markush Group is not based on a scientifically recognized class. In re Ruff, 265 F.2d 590, 597, 18 U.S.P.Q. 340, 347 (CCPA 1958). Also See Engineering Development Laboratories v. Radio Corporation of America, 153 F.2d 523, 526-527, 68 U.S.P.Q. 238, 241-42, (2nd Cir. 1946). In re Saunders, 444 F.2d 599, 607, 170 U.S.P.Q. 2123-220 (CCPA 1971), and In re Johnson, 558 F.2d 1008, 1019, 194 U.S.P.Q. 187, 196 (CCPA 1977). It should be apparent that the various species of claim 33, (e.g., phosphites, borates, oxygen, carbon dioxide and the like) do not fall within the art recognized scientific classes of materials in that the base element falls within a different group of the Periodic Table of Elements. For example, phosphorous comprises a Group VA element, boron a Group IIIA element, oxygen a Group VIA element and carbon a Group IVA element.

The Rejection and Traverse
The Rejection Under 35 U.S.C. § 112 and Traverse

The Examiner rejects claims 1-20, 22-26, 28-55 under 35 U.S.C. § 112, first paragraph. Applicants traverse the rejection and request further consideration and reexamination.

The Examiner rejects the claims "because the specification, while being enabling for compositions, films and coating methods and coated articles including coating compositions comprising the TEOS, MBTC and an accelerant of triethyl borate, triethyl phosphite or water, does not reasonably provide enablement for inventions not using

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the recited silicon oxide precursors and inventions wherein the metal oxide precursor does not comprise a tin oxide precursor." (July 6, 1998 Office Action, page 2, third paragraph) (emphasis added). The Examiner then argues the specification does not enable a skilled artisan to make or use the invention commensurate in scope with the foregoing claims.

Applicants pont out initially that claims 1-20, 22-26 and 28-32 specifically identify the formula for the silicon oxide precursor and that claims 1-20, 22-26 and 28-32 do claim the use of a tin oxide precursor.

Accordingly, the rejection for lack of enablement of inventions not using the recited silicon oxide precursors and inventions where the metal oxide precursor does not comprise a tin oxide precursor would not apply to claims 1-20, 22-26 and 28-32 since these claims include a silicon oxide precursor and a tin oxide precursor.

In order to support the rejection, the Examiner points out that he understands the present application to describe CVD-type coating processes requiring substantially different process conditions, not predictable by one of ordinary skill in the art, basing this conclusion on the discussion of various disclosures on pages 1-4 of the specification teaching a number of silicon oxide precursors not usable for the purposes of the instant invention. (July 6, 1998 Office Action, page 2, last paragraph).

By focusing on applicants' disclosure of silicon oxide precursors not suitable for use according to the instant invention, the Examiner looks at one of the principal features of the invention, namely the applicants' discovery of a class of silicon oxide precursors, used in combination with the accelerants discovered by the applicants that

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permit applying mixed silicon oxide/metal oxide coatings at relatively high rates of deposition.

Column 3, lines 16-20 of the written description emphasizes this in noting:

> To overcome the problems as discussed herein above, silica precursors are needed which are inexpensive readily available, easy to handle, and have adequate deposition rates when vaporized with metal oxide precursors. (emphasis added).

The specification prefaces the foregoing by describing various problems encountered in the prior art with the deposition of silicon oxide coatings. For example, the applicants note that Gordon, United States Patent No. 4,187,336 describes silicon oxide precursors employed in a composition for depositing a mixed tin oxide/silicon oxide film, which provided deposition rates (10-20 Å/sec.) not suitable for commercial industrial production. Gordon, United States Patent no. 4,386,117 also discussed in the present application similarly discloses silicon oxide precursors that have low deposition rates when used to lay down a silicon oxide/tin oxide coating, e.g., 80 to 125 Å/sec.

Accordingly, the applicants singled out one of the factors that prevented high deposition rates as the silicon oxide precursor. As a result, that aspect of the invention dealing with high deposition rates identifies specific silicon oxide precursors in combination with metal oxide precursors and accelerants that the applicants have found will give these deposition rates, i.e., rates greater than 350 Å /sec. Applicants have focused on this aspect of the invention in claims 1-32.

Claims 33-55, however, relate to a film comprising one or more metal oxides and an accelerant (claims 33-38) or an article comprising a substrate and a film comprising

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one or metal oxides and an accelerant (claims 39-55). These claims do not require a description of the components for forming the metal oxides or the article comprising a film of the metal oxide as having the capability of laying down a film comprising a metal oxide at a rate of deposition greater than 350Å/sec, nor do they have to.

Thus, as to the 35 U.S. C. § 112, first paragraph rejection, applicants have provided a disclosure commensurate in scope with the claims requiring deposition rates of metal oxide/silicon oxide film of greater than 350 Å/sec. The novelty, utility and nonobviousness of the other claims do not reside in the selection of silicon oxide precursors that will deposit at rates greater than 350 Å/sec. but in the specifically claimed metal oxide and accelerant.[1]

The Examiner has pointed to nothing in the applicants' disclosure or the other references cited to reject the application for that matter, which in any way suggest that the skilled artisan could not deposit these metal oxide coatings. Again, this aspect of the invention does not depend on forming these coatings at a deposition rate greater than 350 Å/sec., nor does it depend on the selection of a silicon oxide precursor that deposits at greater than 350 Å/sec. when used in combination with metal oxide

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[1] Claim 33 identifies these as metal oxides selected from the oxides of tin, germanium, titanium, aluminum, zirconium, zinc, indium, cadmium, hafnium, tungsten, vanadium, chromium, molybdenum, iridium, nickel and tantalum where the accelerants comprise phosphites, borates, water, alkyl phosphine, arsine and borane derivatives, PH_3, AsH_3, B_2H_6, NF_3, NO_2 and CO_2. Applicants support the claims to a film comprising one or more metal oxides and an accelerant with the disclosure in column 5, lines 40-45, noting they can then replace the tin oxide of the coating entirely or in part by the oxides of other metals such as germanium, titanium, aluminum and the like.

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precursors and applicants' claimed accelerants. Claims 33-35 only require a film comprising the specified metal oxide, and accelerant, and nothing in applicants' disclosure or the references cited by the Examiner supports any rejection that a skilled artisan would not know how to form these oxides.

Columns 1-3 of the present application give references describing the deposition of metal oxides from precursors either by a CVD process or a plasma-enhanced CVD process. Column 4, lines 46-63 gives numerous examples of metal oxide precursors and column 5, lines 4-45 identifies various metals suitable for forming the oxide. Column 4, lines 29-31 and column 5, lines 9-19 lists the various accelerants. Surely a person with ordinary skill in the art, with this disclosure in front of them would know how to form the claimed films comprising one or more metal oxides with the accelerants and the article of manufacture based on those films as set out in claims 33-55.

Thus the Examiner's observation "that a number of silicon oxide precursors are not usable for the purpose of the instant invention" as the Examiner views pages 1-4 of the specification, (July 6, 1998 Office Action, page 2, last paragraph) has no bearing on the issues presented by claims 33-55. However, those claims specifically mentioning silicon oxide precursors for depositing a silicon oxide metal oxide coating at a rate greater than about 350Å/sec., (claims 1-32) specify the silicon oxide precursor with particularity so as to avoid construing the claims as containing silicon oxide precursor such as those of the prior art that do not have the capability of producing coatings at this rate.

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The Examiner further argues that a person "with ordinary skill in the art is given no further direction on how to best choose those precursors that exhibit the required characteristics. For example, U.S. Patent 4, 206,252 describes a process in which volatile silicon oxide precursors are required to have Si -Si Si-H bonds to be useful in the described invention." (July 6, 1998 Office Action last sentence, page 2, first sentence page 3). Again, applicants point out that aspect of the invention dealing with the deposition of silicon oxide coatings at a deposition rate faster than 350-Å/sec., requires specific silicon oxide precursors that exclude Si -Si Si -H bonds. Those claims that do not contain this limitation (Claims 33-55) but broadly claim the coating of a metal oxide on a substrate and that may also include precursors for silicon oxides differ from the references relied on by the Examiner by the species of metal oxides set out in the claims.

Thus the Examiner's statement "that a number of silicon oxide precursors are not usable for the purpose of the instant invention" only states part of the case, and ignores that applicants have discovered silicon oxide precursors with accelerants usable for the purpose of the invention, i.e., depositing a silicon oxide metal oxide coating at deposition rates greater than 350Å/sec. The applicants, also discovered more than this, namely the metal oxide coating with an accelerant of claims 33-55 irrespective of whether the coatings deposit at a rate higher than 350Å/sec.

The Examiner's observation in the July 6, 1998 Office Action, page 2, lines 2-5, that "U.S. Patent 5,028,566 [Lagendijk] explicitly teaches some compounds are unsuccessful when the described process is attempted. The compounds employed in

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U.S. Patent 4,187,336 [Gordon] are described by the instant inventors as producing insufficient deposition rates" fails to take into account the full context in which applicants describe these patents in the specification. Applicants commented in the written description that Gordon, United States Patent No. 4,187,336 describes a silicon oxide precursor that deposited silicon oxide at a rate no greater than from 10 to 20Å/sec. and[2] Lagendijk only found a broad range of "dopants" effective when used with silicon compounds having no carbon-oxygen-silicon bonds, and two or more silicon atoms. But applicants' invention remedied this as set out in claims 1-32 specifying the silicon precursor having carbon-oxygen-silicon bonds contrary to Lagendijk, and that deposit at significantly higher rates than Gordon when using applicants' precursor/ accelerant combinations. Furthermore, claims 33-55 differ from the references by reciting metal oxide accelerant combinations that neither Lagendijk nor Gordon teaches or suggest.

The Examiner goes on to note[3] that applicants stated in the specification "From a review of the prior art, it cannot be determined what precursor combinations, if any, can be used for continuous deposition under conditions and at a rate suitable for mass production, of mixed metal oxide silicon [sic, oxide] films at adequate rates from readily available and relatively inexpensive reagents." (Paragraphs bridging columns 3 and 4 of Russo et al., United States Patent No. 5,401,305).

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[2] Gordon also showed now awareness of the use of an "accelerant" to speed up the process.

[3] July 6, 1998 Office Action, page 3, lines 5-8.

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The Examiner takes the quotation out of context. All of the disclosure prior to that set forth above describes the problem of the prior art in terms of the slow deposition rates of some silicon oxide films. Again, applicants having focused on the production of some silicon oxides at an unacceptable rate for mass production of glass coatings and discovered silicon oxide precursors suitable for mass production that can coat at greater than 350 Å/sec. with an accelerant. The disclosure, taken as a whole, cannot be construed as containing similar teachings relative to the other part of the coating component, namely precursors of metal oxides. The applicants don't claim to coat them at mass production rates, i.e., greater than 350 Å/sec.

The Examiner then argues "if one of ordinary skill in the art cannot predict which conditions are suitable for use under the broad range of conditions described as ' under conditions and at a rate suitable for mass production', one of ordinary skill in the art certainly could not be expected to predict the conditions at which a large number of vastly different compounds may be used without explicit guidance by the instant specification." (July 6, 1998 Office Action, page 3, lines 8-13). Again, the invention does not permit applicants statements relative to the selection of silicon oxide precursors that deposit at a rate greater than 350Å/sec., as covered by claims 1-32, to also apply to that aspect of the invention that does not contain these limitations, namely claims 33-55. Applicants' claims 33-55 distinguish the references of record by the various metal oxides with accelerants specifically set forth in these claims, and combinations with silicon oxide of any deposition rate.

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The Examiner goes on to argue "column 4, lines 13-38 of the patent under reissue require [sic] the presence of a silicon oxide precursor in the coating composition of the broadest invention described." (July 6, 1998 Office Action, page 3, lines 16-18). The Examiner, however, overlooks the broadest invention described in applicants great-grandparent application which the present reissue application now claims because the parent application omitted it due to an error without deceptive intention. The great-grandparent application in this regard claimed by way of claim 1:

> A composition for coating a substrate comprising at least one metal oxide precursor and at least one deposition-rate enhancing material.

whereas claim 20 claimed:

> An article obtained by deposition onto a substrate of a coating from metal-oxide coating precursors, comprising at least one deposition-rate-enhancing substance.

(See, Exhibit 1 attached to applicants' response of March 29, 1998). These broad statements of invention in claims 1 and 20 of the great-grandparent application, contrary to the Examiner's position, do not require the presence of a silicon oxide precursor although the breadth of the claims would include it.

The Examiner also argues that applicants have not provided sufficient guidance in the written description to enable a skilled artisan to select an accelerant. The Examiner notes in this regard "triethylphosphite and triethylborate are demonstrated as effective and the system temperature at which they must be employed is disclosed (see tables 1 and 2). Other materials such as added MBTC or oxygen alone are described

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as insufficient." (July 6, 1998 Office Action, sentence bridging pages 3 and 4 and first sentence on page 4).

As to the latter argument, applicants have never made a statement that they found MBTC or oxygen alone insufficient as accelerants. The Examiner, without stating where he finds basis for this argument most likely refers to column 7, lines 44-47 of the written description which states that excess MBTC acts as a Lewis acid, and that "as the concentration increases, the rate increases, although not to the levels needed for commercial application." An extrapolation of the data forming the basis for this observation (Table IV of the written description) would show that increasing the concentrations of MBTC would also increase the deposition rate.

Applicants made similar observations relative to added oxygen as set forth in column 7, lines 28-31 that by "increasing the oxygen concentration. . .deposition. . . [increases] significantly, but not to the levels needed for commercial application." Table III of the written description contains the data forming the basis for this statement but also shows that extrapolation of the oxygen content would give an increase of the deposition rate.

In any event, applicants' statements relative to MBTC and oxygen never described the results as insufficient, but only that with the limited experimentation they did not achieve levels of deposition needed for commercial application.

The Examiner also states that "Column 7 [sic, 9], lines 28-32 teach that the combination of an accelerant of TEP or TEB and TEOS/MBTC are synergistic with respect at least to the process condition of deposition rate providing further evidence

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that determining the required process conditions would not require undue experimentation on the part of one of ordinary skill in the art." (July 6, 1998 Office Action, page 4, lines 4-7). Applicants agree with the Examiner.

In any event, applicants have not claimed that all combinations of accelerant and oxide coating precursors give synergistic results, only that the invention provides novel, useful and unobvious compositions, films and articles of manufacture. The fact that applicants discovered a synergistic composition enhances the novelty, utility and unobviousness of an aspect of the claimed invention, but does not detract from the novelty, utility and nonobviousness of those compositions that do not show synergy. Title 35 of the United States Code does not require synergy for all inventions. Importantly, a person with ordinary skill in the art, with the written description of the invention before them, would know how to make and use the invention without undue experimentation, even though this skilled artisan may not find synergy in every aspect of the invention, nor is the skilled artisan required to experiment until they do find synergy, but only that they can make and use the invention.

The Rejection Under 35 § 251 and Traverse

The Examiner rejects claims 33-55 under 35 U.S.C. § 251. Applicants traverse the rejection and request further consideration and reexamination.

The Examiner repeats his rejection of March 3, 1997, page 3, second paragraph through page 4. Applicants traverse the rejection on the same grounds as set forth in

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applicants' March 24, 1998 response, pages 18-25, which applicants incorporate herein by reference.

Briefly, however, claims 33-55 do not broaden subject matter rejected in the parent application or for that matter in great-grandparent and grandparent applications. The Examiner in the present application, therefore, cannot invoke the so-called "recapture rule" as set out in Ball Corp. v. United States, 729 F.2d 1429, 221 U.S.P.Q. 289, 295 (Fed. Cir. 1984), and the prohibition against broadening as set out in Mentor v. Coloplast, 998 F.2d 992, 27 U.S.P.Q. 2nd 1521, 1524 (Fed. Cir. 1993) and assert that it bars the patentee from acquiring, through reissue, claims of the same or broader scope than the original application. This aspect of the recapture or broadening rule only pertains to instances where applicants amended the parent application to obtain issuance, not as in the present case, where the parent application, through error without deceptive intention failed to include subject matter disclosed and described as part of the applicants' invention. The great-grandparent and grandparent applications, as well as the written description of the parent application described this as part of the applicants' invention. Most importantly, the applicants did not amend the claims of the great-grandparent, grandparent or parent application to exclude this subject matter in order to obtain allowance.

The Rejection Under 35 U.S.C. § 112(4) and Traverse

The Examiner rejects claim 30 under 35 U.S.C. § 112(4). Applicants traverse the rejection and request further consideration and reexamination.

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Specifically, the Examiner states "claim 30 is rejected under 35 U.S.C. § 112(4), as failing to further limit the parent claim as a silicon oxide precursor is already required by the parent claims as amended." (July 6, 1998 Office Action, page 5, first full paragraph). Applicants request clarification of the rejection, since they do not fully understand it. Applicants, however, point out that applicants amended claim 28 on November 27, 1996 to include specific silicon oxide precursor compounds in the same way that the allowed claims of the reissue application defined these precursors. Applicants also point out that claim 30, presently under rejection, depends from claim 28, and if the Examiner requires claim 30 to contain this recitation of the silicon oxide precursor, applicants point out that claim 30 presently does this by virtue of its dependency on claim 28.

The Rejection Under 35 U.S.C. § 102(b) and Traverse.

The Examiner rejects claims 33-35, 37-41 and 43-55 under 35 U.S.C. § 102(b) as anticipated by Gordon, United States Patent No. 4,187,336 [hereinafter "Gordon' 336"]. Applicants traverse the rejection and request further consideration and reexamination.

The Examiner takes the position that Gordon '336 describes formation of a continuously graded mixed tin/silicon oxide film on glass from a gaseous composition of a tin oxide precursor, a silicon oxide precursor and water or oxygen gas at 480°C. The Examiner refers to Example 4 and Table E, column 6, lines 1-56 to support the rejection.

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In the first instance, as noted above, applicants have canceled the use of oxygen as an accelerant from claim 33 (as amended to include the metal oxides and accelerants of claims 33, 34 and 35).

Although Table E of Gordon '336 describes the use of water as a source of oxygen, Table E limits the use of water for the deposition of "silicon oxynitride films" and not films of tin and silicon oxides as the Examiner states. Furthermore, the Table E data show that this aspect of Gordon '336 also requires a source of nitrogen including materials such as hydrazine, ammonia and the like (Gordon '336, column 10, lines 26-29). The reference only teaches the use of water as an oxygen source in forming oxynitride films and contains no teaching or suggestion of using water as a source of oxygen to form a metal oxide as distinguished from an oxynitride film. In fact, when comparing Table D in adjacent column 9, which describes compositions for forming metal oxide layers using metal precursors in combination with oxygen or nitrogen oxide, the skilled artisan would conclude that the omission of water from the oxidizing materials (oxygen and nitrogen oxide) would suggest its unsuitability for this purpose.

Accordingly, by deleting oxygen gas from the accelerants in newly amended claim 33, and with Gordon in effect teaching away from the use of water as an oxidizing material by only employing it in the formation of oxynitride films, Gordon '336 does not anticipate claims 33-35, 37-41, or 43-55.

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The Rejection Under 35 U.S.C. § 103(a) and Traverse

The Examiner rejects claims 1-32, 36 and 42 under 35 U.S.C. § 103(a) as unpatentable over Gordon '336 and further in view of Lagendijk, United States Patent No. 5,028,566. Applicants traverse the rejection and request further consideration and reexamination.

The Examiner argues that even though Gordon does not teach the silicon oxide precursors of applicants claims 28-32, Lagendijk allegedly teaches silicon oxide precursors within the scope of the claims for use in CVD. The Examiner then states "it would have been obvious to one of ordinary skill in the art at the time the invention was made to employ those compounds in order to obtain the disclosed advantages." (July 6, 1998 Office Action, page 6, third full paragraph). Applicants cannot respond to this argument since they do not know what the Examiner refers to by "those compounds" and the "disclosed advantages." Applicants request that the Examiner specify which compounds and which advantages.

To the extent applicants understand the rejection, neither reference contains any motivation for combining the teachings of one with the other for several reasons. See MPEP § 2143.01.

In the first instance, Lagendijk has not recognized that several compounds such as phosphorous or boron based materials function as accelerants, rather, the reference describes these materials as "dopants." (Lagendijk, column 8, lines 19-29). In fact, the very limited species of silicon oxide precursors that lay at the core of the Lagendijk invention would seem to deposit at very low rates and the reference neither teaches nor

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suggests that the dopants in any way positively affected the deposition rate, i.e., acted as accelerants.

Lagendijk in this regard describes the deposition of a silicon oxide film or doped silicon oxide film on a semiconductor device at reduced pressure for a period of time to form the desired thickness of film "readily calculated from the rate of deposition. . . . The rate parameters are easily ascertained for a given system and are somewhat a function of the system, thus no one set of rate data is significant, and certainly not critical to the invention." (Lagendijk, column 5, lines 59-64) (emphasis added). Thus, Lagendijk admitted that nothing in his formulation affects deposition rates one way or another.

Gordon '336, on the other hand, does not teach or suggest "dopants" for combination with the various oxide and/or silicon oxide films disclosed, but rather "oxidizing agents." More significantly, Gordon '336 says nothing about compounds added to the film forming precursors increase the deposition rate. The skilled artisan therefore, in combining the teaching of Lagendijk that "no one set of rate data is significant, and certainly not critical to the invention" with the teachings of Gordon '336 which contains nothing about increasing deposition rates, let alone providing a "dopant" with the film forming precursors, would have no motivation to combine the two teachings. This combination of references clearly presents the question: what would motivate the skilled artisan to make the combination?

The obviousness rejection cannot stand where it relies on applicants' disclosure of certain combinations of materials and the Examiner's citation of references showing

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those materials individually, but not the combination. In order for the rejection to stand, the references also have to show some reason for making the combination. If nothing else, Lagendijk would teach away from that combination, again with the observation that with regard to the combinations he evaluated "no one set of rate data is significant, and certainly not critical to the invention."

The Examiner also states "the difference between claims 36 and 42 and the instant claims is the compound employed as accelerant." (July 6, 1998 Office Action, page 6, fourth full paragraph) Applicants request clarification of the rejection since they cannot tell what the Examiner means by "the instant claims." Claims 36 and 42 comprise two of the claims under the 35 U.S.C. § 103(a) rejection and therefore can be considered "instant claims."

In any event, the Examiner goes on to observe that Lagendijk teaches the addition of trimethylborate or triethylphosphite to CVD compositions and concludes the skilled artisan would have found it obvious to add triethylphosphite to the composition of Gordon in order to obtain the advantages disclosed by Lagendijk. Applicants have addressed this combination of references above and incorporate their remarks distinguishing the two references in order to address the rejection.

Conclusions

Applicants request that the Examiner withdraw the rejection in view of the foregoing amendments and remarks and pass the application as amended to issue.

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If filing this response requires an extension of time pursuant to 37 C.F.R. § 1.136 and payment of an extension fee or other fee, any of which this response fails to account for, applicants' attorneys request such an extension and charging such fees to their Deposit Account No. 06-0916.

Respectfully submitted,

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By:_____
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